

Turbulent fluctuation and transport of passive scalars  
by random wave fields.

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Abstract:

We show that turbulent transport by random wave fields provides a new and important contribution to passive scalar transport in the ocean. The existence of the small parameter  $u_0/c_0$ , where  $u_0$  and  $c_0$  are the characteristic particle velocity and wave phase speed, respectively, allows essentially exact calculations, and as such provides a rich testing ground for quantitative comparisons between theory and observation. General expressions for the diffusion coefficients tensor and mean drift velocity are exhibited and discussed. The drift velocity, for example, induced by long internal gravity waves can be comparable to ocean interior currents. Even more interesting is the spectrum of passive scalar fluctuations, which is found to display at least two distinct inertial-range power laws even when the wave velocity field has only one. The theory is supported by satellite measurements of Chlorophyll-*a* concentration which in certain ocean regions indeed appears to exhibit spectral power laws consistent with those predicted to accompany internal wave-induced transport.